



# Agricultural and Resource Economics ARE UPDATE

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## California Almond Industry Harmed by International Trade Issues

Colin A. Carter and Sandro Steinbach

California almond tree acreage has expanded by roughly three-fold since 2000. As a result, the industry relies more on foreign buyers to purchase the growing supply of almonds. Combined with the acreage growth, recent international trade disputes and supply chain problems have resulted in an over-supply of California almonds, with end-of-year inventories close to an unusually high 30% of the harvest. We investigate the role of trade disputes and supply chain issues on the economics of the California almond industry.

Almonds are the most valuable crop produced in California, and over 70% of the harvest is exported internationally. The annual value of almond exports is over \$4.5 billion, far higher than any other agricultural product shipped out of California. Grower prices for almonds are down over 25% since 2019 and are now below production costs for those farmers who are paying high prices for irrigation water. Warehouses are full, and temporary storage is being relied upon at higher storage costs. The economic problems facing almond growers started with

the 2018 U.S.-China trade war and were exacerbated by the shipping container problems on the West Coast in 2021. Most California almonds are shipped out of Oakland. Recently, trucker protests at the Port of Oakland over California’s Assembly Bill 5 (AB5) law have slowed almond exports further, just as the new harvest is coming in.

In response to the U.S.-initiated trade war, retaliatory import tariffs imposed by foreign buyers cost the California almond industry almost 325 million pounds (or \$875 million) in lost export shipments from April 2018 through April 2022. The impact of the 2021/22

shipping container disruptions was even larger on an annualized basis: between April 2021 and April 2022, almond exports were reduced by an estimated 290 million pounds (or \$870 million).

Table 1 summarizes California’s almond supply and demand from the 2016/17 marketing year—from August through July—to the 2021/22 marketing year. As shown in Table 1, from 2016/17 to 2018/19, growth in almond exports kept up with the expanding domestic supply, and the industry enjoyed relatively high producer prices. These trends were then interrupted in the 2018/19 marketing year

Table 1. California Almonds Supply and Demand (Billion Pounds, Shelled Basis)

	Marketing Year					
	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
Marketable Crop	2.09	2.21	2.22	2.50	3.04	2.86
Ending Inventory	0.40	0.36	0.32	0.45	0.61	0.84
Domestic Shipments	0.68	0.73	0.74	0.77	0.81	0.76
Export Shipments	1.42	1.52	1.52	1.60	2.09	1.87
Producer Price (\$/lb)	2.53	2.50	2.45	1.71	1.76	1.80*

Note: \*The price for the marketing year 2021/22 is estimated by the authors.

Source: The supply and demand data are from the Almond Board of California. The producer price is from the National Agricultural Statistics Service.

**Table 2.** Foregone Almond Exports to China, India, and Turkey (Million Pounds)

Marketing Year	China		India		Turkey	
	In-shell	Shelled	In-shell	Shelled	In-shell	Shelled
2017/18	-1.6	-4.4	0	0	0	-0.5
2018/19	-19.9	-31.9	-0.9	-0.2	-5.5	-8.1
2019/20	-48.3	-46.8	-8.1	-2.1	-3.6	-8.8
2020/21	-22.6	-31.6	-11.3	-2.8	-2.8	-10.9
2021/22*	-22.8	-11.0	-8.6	-3.1	-3.0	-6.2
<b>Total</b>	<b>-115.1</b>	<b>-125.8</b>	<b>-29.0</b>	<b>-8.2</b>	<b>-14.8</b>	<b>-34.5</b>

Note: \*The 2021/22 marketing year (August to July) includes data through April 2022. The in-shell quantity was converted to pounds using a conversion factor of 0.7.

All data are reported in million pounds kernel equivalent and the total by export destination is provided.

Source: These are the authors' estimates.

after the implementation of retaliatory tariffs by foreign trading partners. The 2021/22 container shipping disruptions at California ports compounded the trade-war effects.

The supply and demand situation has eased somewhat because of the drought, and low crop prices curtailed water use and lowered the 2022 harvest volume by about 6% from the previous year. However, almond inventories continued to build up, reaching 840 million pounds at the end of the 2021/22 marketing year. They are now up over two and one-half times since the beginning of the trade war.

The strong U.S. dollar and rising input costs have provided new headwinds for the almond industry. In addition, a looming economic recession in the European Union (EU) due to high energy prices related to the Russian invasion of Ukraine could result in lower California exports to the European Union. The recent dramatic rise in the price of natural gas and electricity in Europe is an economic shock to that region as large as the effects of the Arab oil embargo on oil prices in 1973. Reuters has reported that, this coming winter, European households will spend an average 10% of their household income on energy bills, twice the amount they spent in 2021. Finding

other importers willing to take on lower-grade almonds used in food processing for traditional European baked goods like marzipan will be difficult for California producers.

### The Trade War and Retaliatory Tariffs

In 2018, the U.S. government implemented new import tariffs on steel (25%) and aluminum (10%); the stated reason was for national security. The main targets of these tariffs were China, Canada, Mexico, and the European Union, but other countries were also affected by U.S. tariffs. Several countries responded by imposing retaliatory tariffs on unrelated imports from the United States. These duties restricted U.S. almond exports considerably. China and Turkey levied import tariff increases on in-shell and shelled almonds from the United States of 45% and 10%, respectively. India followed in June 2019, increasing import tariffs (expressed as the ad valorem equivalent) on U.S. almonds to 17% for in-shell and 32% for kernels. This exceeds India's World Trade Organization (WTO)-bound tariff rates.

Table 2 summarizes our estimates of the export losses due to retaliatory tariffs imposed by our international

trading partners for the marketing years 2017/18 to 2021/22. We used a statistical model to estimate the export response to retaliatory tariffs for California almonds, accounting for the reallocation of exports among retaliatory and non-retaliatory markets. The model accounted for unobserved characteristics through high-dimensional fixed effects and used historical trade data from January 2017 to October 2019 to calculate the almond-specific trade responses to the retaliatory tariffs. We then used those estimates to predict the trade effects for marketing years 2017/18 to 2021/22.

We reported trade impacts for China, India, and Turkey because they all imposed retaliatory tariffs against California almonds. The current marketing year includes estimated export losses until April 2022. As a result of the retaliatory tariffs, we estimate that more than 325 million pounds (or \$875 million) in California almond exports were lost. Foregone almond exports to China (-240 million pounds), Turkey (-50 million pounds), and India (-35 million pounds) drove these trade losses. The trade effects were equally large for in-shell and shelled almonds to China but were more pronounced for in-shell almond exports to India. The export losses peaked in the 2019/20 marketing year when the volume of almond exports to retaliatory-tariff countries was almost 120 million pounds below the counterfactual level.

Since the 2019/20 marketing year, the annual export loss was halved due to the Phase One deal with China—which was implemented in March 2020—and Turkey's unilateral reduction of its retaliatory almond tariff from 20% to 10% in May 2019. However, today the almond industry faces significant uncertainty over the potential for the Chinese government to end the current tariff exemption process. The current waiver applies to

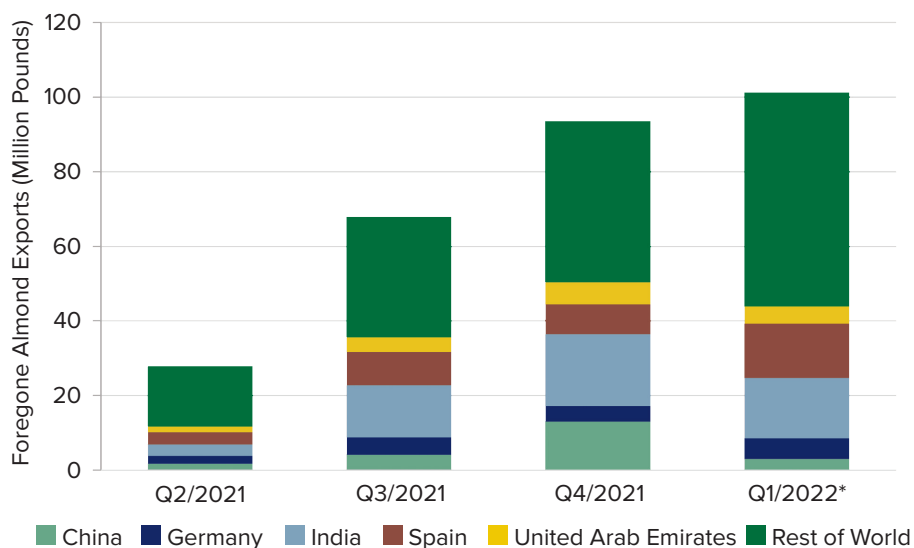
retaliatory duties against Section 301 of U.S. trade law, while the retaliatory duties against Section 232 (15%) remain in place. With stalling U.S.-China trade negotiations, a failing Phase One deal, and rising tensions over Taiwan, the Chinese government could halt the tariff exemptions for U.S. almonds.

Recently, China and India have negotiated favorable trade agreements with Australia. As a result, Australian almonds can be imported into China at a 0% tariff. After Australia's new trade agreement (signed on April 2, 2022) with India is ratified, almonds from Australia can be imported to India under a significantly lower tariff than U.S. almonds. However, it remains to be seen whether Australian producers can capitalize on this opportunity, given the considerable time and resources needed to expand production further in the Murray-Darling basin with its extreme water issues.

### Shipping Container Backlogs

The 2021/22 shipping container disruptions also cost the California almond industry. Almonds destined for the export market filled warehouses and temporary storage as the industry grappled with the transportation disruptions at California's ports. We conducted an event study—an empirical analysis of how the market responds to a significant event—to measure the trade effects of port congestion on containerized almond exports from California ports. We used historical trade data for California ports to measure how the 2021 port congestion and container shortages impacted almond exports. Our model controlled for unobserved factors with port-product-year and port-product-month fixed effects. We assigned May 2021 as the treatment month and constructed an event window of eight months before and after the pretreatment month of April 2021. The statistical model identified the treatment

**Figure 1. Foregone Almond Exports Due to Shipping Disruptions (Million Pounds)**



Note: \*The elasticity estimates for container trade disruptions in January 2022 were used to estimate export losses for Q1/2022.

The in-shell quantity was converted to pounds using a conversion factor of 0.7. All data are reported in million pounds kernel equivalent.

Source: These are the authors' estimates.

effect by comparing containerized almond exports in 2021/22 with those from 2014–2018. The volume of California exports was 19% below the counterfactual level between May 2021 and January 2022. The estimated trade effects were driven by many factors, including limited access to containers for agricultural exports, port congestion, and higher freight rates.

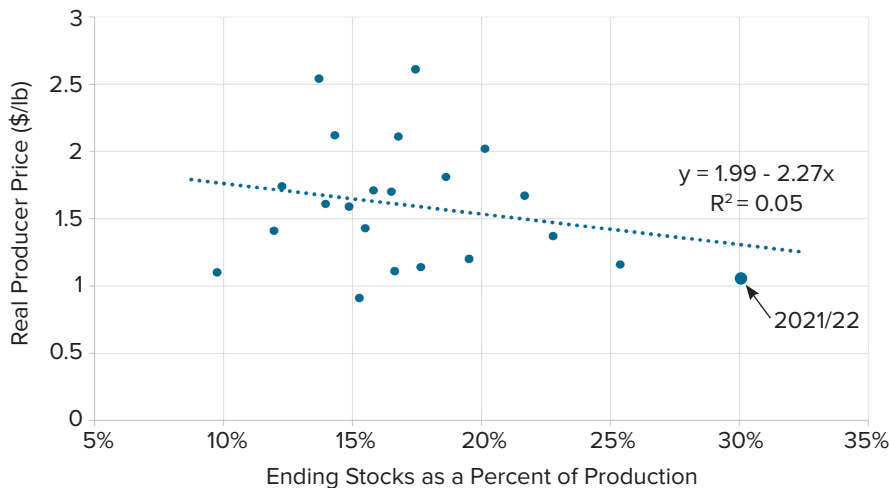
Figure 1 shows the foregone export shipments for major trading destinations, in a hypothetical world without shipping container disruptions. We estimate that shipping container disruptions reduced California almond exports by 290 million pounds (or \$870 million) between quarter 2 of 2021 (Q2/2021) and quarter 1 of 2022 (Q1/2022). However, this varied considerably during the marketing year and depended on the export destination. The most significant losses were recorded during Q4/2021 and Q1/2022, when the volume of almond exports was about 25% below the counterfactual level. These trade losses translate into aggregated

foregone shipments of about 95 million pounds in Q4/2021 and 100 million pounds in Q1/2022. Exports to India were reduced the most (-50 million pounds), followed by Spain (-35 million pounds) and China (-20 million pounds).

### Inventories

As in any commodity market, inventories are essential in the almond market to help smooth production from year to year, facilitate supply chain management, avoid costly stockouts, and thereby reduce overall marketing costs. Indeed, inventories are an essential component of the supply of almonds to domestic and world markets because inventories are a form of production control. The marginal value of inventories is the value associated with holding an additional unit of inventory, and it can be viewed as the savings in marketing costs resulting from owning one additional unit of inventory. The marginal value is inversely related to the size of inventories. Now, when inventories are relatively large, the marginal value

**Figure 2.** Real Producer Price (2000 Dollars) and Ending Stocks for California Almonds



Note: The real price is the producer price adjusted by the national producer price index (PPI) based on 2000 dollars. The PPI is the PPI for all commodities. A linear fit is overlaid.

Source: The PPI comes from the Federal Reserve, the producer price is from the USDA's National Agricultural Statistics Service, and the stock and production data are from the USDA's Foreign Agricultural Service.

of an additional unit of inventory is very small. At the same time, the marginal cost of holding inventories is rising with higher interest rates. This is one reason that market prices are relatively low.

As mentioned above, by the end of marketing year 2021/22, California's almond closing stocks (i.e., inventories) increased to 840 million pounds, up from 320 million pounds in 2018/19. This can largely be attributed to a slowdown in the growth of export shipments. Figure 2 reports two decades of data on end-of-year almond stocks (i.e., inventories) versus grower prices, adjusted for inflation (base = 2000).

There are two important takeaways from this figure. First, the 2021/22 combination of stock levels and price (indicated by the arrow) is somewhat unusual. Stocks as a percent of production are close to 30%, and the price is relatively low compared to the last twenty years, after accounting for inflation. Second, there is an overall negative relationship between stock levels and prices. Figure 2 shows that higher stocks relative to the size of

the harvest depresses grower prices: a 10% increase in inventories as a share of production results in a \$0.30 per pound price decline.

## Conclusion

California almond exports have been harmed considerably by foreign tariff retaliation in response to the 2018 U.S.-initiated trade war. These trade losses occurred in major export markets that had experienced significant economic growth due to rising incomes and shifting demand for high-quality tree nuts. The changing trade environment challenges the leading position of California almond producers in foreign markets.

Global shipping container disruptions compounded the adverse effects of retaliatory tariffs, harming California almond exports even more than trade retaliation did. The most significant losses were observed for almond exports to India, Spain, and China.

These international trade losses have put downward pressure on grower prices and at the same time increased almond stocks. Without trade retaliation and container shipping

disruptions, we estimate the ending inventory in 2022 would be about 50% below the current level. This considerable increase in almond inventories since the beginning of the trade war will likely depress almond prices for the next few years.

### Suggested Citation:

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### Authors' Bios

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### For additional information, the authors recommend:

Carter, Colin A. and Sandro Steinbach. 2020. "The Impact of Retaliatory Tariffs on Agricultural and Food Trade." *NBER Working Paper w27147*. Available at: <https://bit.ly/3BvM5cT>.

Carter, Colin A., Sandro Steinbach, and Xiting Zhuang. 2021. "'Containergeddon' and California Agriculture." *ARE Update* 25(2): 1-4. Available at: <https://bit.ly/3UarHXf>.

Carter, Colin A., Sandro Steinbach, and Xiting Zhuang. 2022. "Supply Chain Disruptions and Containerized Agricultural Exports from California Ports." *Applied Economic Perspectives and Policy*. Available at: <https://bit.ly/3dv5lzi>.